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14. ABSTRACT

This paper attempts to measure the impact of Islamic finance on financial crises and the volatility of the business cycle via capital structure. The results show that Islamic, interest-free finance decreases crises by decreasing the total amount of external debt liabilities. Meanwhile, the models show no significant impact of Islamic finance upon the volatility of the business cycle. Thus, regulations limiting leverage and decreasing the tax advantage of debt may limit financial crises with little adverse effect upon business cycles.

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Abstract

In light of the recent, global financial crisis, countries have discussed regulating firm leverage. Many firms and households were overleveraged during the crisis and such leverage has been blamed for exacerbating a debt-deflation crisis. By limiting the amount of debt that financial firms can carry, regulators hope to prevent future debt-deflation crises. Restricting the financing of firms, however, may have negative effects. According to financial accelerator theory, investment is tied to net worth. If firms are prohibited from taking on debt, the relationship between investment and equity prices is stronger, as firms must issue equity to raise capital. Thus, when economic conditions are poor, investment drops precipitously. As a result, limiting leverage may deepen recessions, exacerbating the volatility of the business cycle. The development of an interest-free financial system under Islamic finance offers insight into the effects of a leverage constraint. To comply with Islamic financing constraints, Islamic firms have developed financial products with characteristics of both equity and debt, altering their optimal capital structure. This paper attempts to measure the impact of Islamic finance on financial crises and the volatility of the business cycle via capital structure. The results show that Islamic, interest-free finance decreases crises by decreasing the total amount of external debt liabilities. Meanwhile, the models show no significant impact of Islamic finance upon the volatility of the business cycle. Thus, regulations limiting leverage and decreasing the tax advantage of debt may limit financial crises with little adverse effect upon business cycles.

Key words: External Capital Structure, Crisis, Islamic Finance, Interest-free, Finance, Business Cycle

DEDICATED TO MY GRANDFATHER, FELIX HAAS,

WHOSE COURAGE AND INTELLECT I ADMIRE

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Lastly, and perhaps most enduring, it is said that you never make it through a day at the Naval Academy by yourself. Brothers and sisters, I am tearful with pride and joy at how supportive you have been in sustaining me through this project and our four years here.

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I. Introduction

Optimal capital structure combines both debt and equity. However, many blame overleverage and binding leverage constraints for having caused the 2008 world financial crisis, the sudden stops in emerging markets in the 1990s, and other crises in history. In these cases, international capital markets penalized overleveraged firms and households. Lenders realized that borrowers were overleveraged and downgraded the debt of borrowers. The borrowers could not roll over their debt; margin constraints became binding. In the recent US housing crisis, as mortgage defaults spread, people and banks sold or foreclosed houses to pay off debt as homeowners dipped into negative equity. As a result, asset prices spiraled downwards, and more people were unable to roll over their debt. Debt-deflation can trigger sovereign debt crises as well. When investors realized Greece was overleveraged, they downgraded its debt, and thus Greece found rolling over its debt to be more expensive.

Given the link between overleverage and financial crisis, various countries have considered regulations to limit leverage in the hopes that doing so will protect them from future financial crises. Last year, the Congress of the United States passed a bill limiting leverage on banks that pose a systemic risk to the economy. Previously, banks were limited to holding assets worth 21 times their paid-in capital, retained earnings and reserves (US Code 2004). The proposed bill made a financial stability oversight council with the power to recommend stricter leverage limits for bank holding companies. The first consideration for recommending additional oversight of each company is listed as the degree of leverage of the company (111th Congress). Additionally, the US Commodity Futures Trading Commission proposed a 10:1 leverage limit for foreign exchange traders in the US. Clearly, then, legislators and regulators believe that overleverage can trigger crises.

While a restriction on leverage may decrease crises, theoretical models suggest that limiting leverage could exacerbate the volatility of the business cycle. Models of financial accelerators find that financial accelerators propagate economic shocks more strongly in the presence of limits on leverage. By prohibiting, or limiting, debt, firms' investment is much more tied to their net worth and the ability to issue equity. Thus, economic conditions affect investment more strongly and investment varies procyclically, exacerbating recessions.

Motivated by the timeliness and current policy discussion, this paper aims to understand the potential costs and benefits of policies that discourage or prohibit interest-bearing contracts. Such policies would have the effect of limiting the types of liabilities companies could have. In the countries like the United States, such policies might include eliminating the tax incentive of debt and constraining the leverage of large, critical financial firms and futures traders. In other countries, government and financiers have already been pursuing interest-free finance for religious reasons. By prohibiting or discouraging the charging of interest on debt, such countries may decrease their leverage. Interest-free finance as an idea is best represented by the experience of Islamic finance, and any empirical analysis of prohibitions on interest is best studied with Islamic finance.

Islam includes rules for finance that scholars and financiers have adopted in order to develop an alternate financial system. The most distillable tenet of Islamic finance is the prohibition on interest. The aversion to interest-bearing debt manifests as a soft constraint on the leverage of firms – soft in that firms are often not legally prohibited from carrying debt, but comply in order to access a financing base. The Islamic finance movement has developed alternative financial products and a body of literature all designed around a lack of interest-bearing debt. Indeed, one may examine Islamic finance to draw empirical conclusions about

interest-free finance. According to Sharia, the legal interpretation of Muslim religious proscription, charging interest upon loans is *riba*, or usury. Sharia also prohibits, *gharar*, outright bets on the economy (such as credit default swaps) and *qimar*, anything judged to be excessively risky. Since the middle ages, Muslim governors have sporadically attempted to eradicate the charging of interest on loans. Such a practice was not limited to Islam, as both Christianity and Judaism have prohibitions on charging interest. The Islamic religious revival of the latter half of the 20th century has lead to thought on how to develop a financial system that did not charge interest on debt. Many Muslims desired to create a more religiously compliant financial system. These practitioners avoided or prohibited charging or paying interest on debt.

Individuals and international organizations have developed much of Islamic financial theory and the corresponding financial institutions.[1] Since the late 1970s, members of countries in which the majority of the population practices Islam have attempted to direct their finance to comply with Sharia. The first modern Islamic financial institutions emerged in 1963: the Mit Ghamr bank in Egypt and the Pilgrimage Savings Corporation in Malaysia. The Malaysian experiment continued, but Mit Ghamr closed after four years. During the 1970s, the Islamic Development Bank was incorporated as a multinational development bank that sponsored research into interest-free economics. Scholars from the International Monetary Fund (IMF) researched theoretical interest-free finance a great deal during the 1980s. In the 1990s, several international organizations attempted to clarify the regulations that Islam mandates. Most prominent among them, the Accounting and Auditing Organization for Islamic Financial Institutions, or AAOIFI, was formed in 1990 to provide standards for Islamic finance. Their work has aided and impelled other firms to pursue Sharia-compliant financing. The

[1] Iqbal and Mirakhor (2007)explain the history and implementation of Islamic finance more fully in An Introduction to Islamic Finance; Theory and Practice

establishment of the AAOIFI at the same time that several Muslim countries were attempting to bring their financial systems in compliance with Islam marks a watershed in the development of Islamic finance.

Many governments have lead national efforts to implement Islamic finance, and the attempts have not occurred simultaneously, identically, or even according to the same interpretation of Sharia. Pakistan, Iran, and Sudan all attempted to transform wholly their financial system to be Islamic by 1983. On the other hand, some countries, such as Tunisia, have pursued no government-led effort to change finance. Other countries, like Malaysia and Bahrain, let Islamic Banks develop within their larger, conventional financial system in the 1980s. The first Islamic bank in Bahrain was established in 1979, and the first in Malaysia in 1983. Later, the central bank established regulatory support for Islamic finance. However, Malaysian Islamic jurisprudence has traditionally been more liberal than that of Saudi Arabia or Sudan. As a result, some Islamic financial products are occasionally declared non-compliant with Sharia by another arbiter. However, since Malaysia is one of the most financially developed Muslim countries, it is the only one in which certain financial services are widely available, such as consumer saving and deposits for the average person. In fact, Malaysia is the only country that fully segregates conventional demand deposits from their Sharia-compliant counterparts.

To address the financing needs of firms that are prohibited from taking a conventional loan, Sharia-compliant financial institutions have developed a variety of substitutes. For example, the legal theory recommends profit-and-loss-sharing (PLS) schemes, where a manager and investor each take a proportional share of profits based upon percentage contribution to the fund, with a slight favor towards the manager. Thus, PLS functions similarly to a mutual fund. As another example, instead of borrowing money from a bank to buy an office building, a firm

will arrange for the bank to buy or build the building and then rent it to the firm. There is even the option for the firm to take ownership of the building once the lease expires. Although a rent-to-buy contract behaves in a similar fashion to a loan in normal times, this loan substitute behaves more like permanent capital in distress situations. Similarly, *mudarabah* (mutual fund) managers may forego some of the profits on their capital in order to create some buffer capital, which can even out the returns of investors in the *mudarabah*. These products can be securitized in what are termed *sukuk*.[2] Currently, consumer analogs are rare, but exist. For everyday consumers in much of the Muslim world, most do not have access to special Sharia-compliant financing or depositary institutions. Thus, they accept conventional finance (though it continues to be replaced by Islamic finance).

Currently, the market for Islamic financial products is small but growing. Even before Islam motivated the development of a modern, robust financial system, it still had an effect on the market. Where there were no Islamic financial institutions, some Muslims simply hoarded money rather than deposit it in an interest-bearing account or put all of their investments in equity (Habibi, 1987). Even still, in regions where specialty finance does not penetrate, many Muslims refuse conventional finance (Karim et al 2008). By comparison, in financial centers, new secondary market issuance in Islamic products grew at roughly 48% per year from 2001 to 2009 (Damak 2010). As evidence, the Dow Jones recently started tracking the Islamic securities market with an indicator in 2005. Most international investment banks such as Deutsche Bank, Banque Nationale de Paris (BNP)-Paribas, and Hong Kong-Shanghai Bank of China (HSBC) have arms that deal in Islamic financial products, and the biggest skyscrapers in Cairo, Dubai, and Bahrain house Islamic banks providing finance without interest to firms and investors in the

[2] However, Islamic financial scholars have disputed the legality of sukuk. In November 2007, Sheikh Taqi Uthmani argued that the vast majority of sukuk are non-compliant with Sharia (Laldin, 2011).

region and in the United Kingdom. Malaysia has the most robust regulatory infrastructure for Islamic finance in that it authorizes firms to participate in both conventional finance as well as their Islamic Banking System (IBS), with active participation by the central bank, so long as finance from the two sources are completely segregated. Singapore, Indonesia, Bahrain, Dubai, Pakistan, Saudi Arabia, Iran, and many others have some Islamic financial institutions or are fully Sharia-compliant.

Enforcing a prohibition on interest raises difficult questions that Islamic financial scholars are currently debating. Even interest-free loans, if tradable, can effectively create interest. If a borrower sells a 0% coupon loan at a discount, it effectively pays interest. Thus, the sale of debt is prohibited. Insurance, or *takaful*, poses another problem. In the middle ages, when the church in Europe prohibited charging interest, financiers circumvented the regulation with *contractum trinius*, an equity investment where the seller provides profit insurance below a certain rate and the buyer sells excess profit above that rate back to the seller. Thus, Islamic financial scholars debate and develop rules on a variety of nuance. For example, can a firm hold goods or capital in escrow in exchange for cash? Yes, so long as they physically take ownership of the goods. What if they arrange for the transfer of ownership, but do not actually take hold of the goods? Once again, the answer is nuanced. Ultimately, financers may not buy and sell the same asset from the same agent in order to create financing without an effective transfer of assets. Additionally, if Sharia prohibits excessive risk, what constitutes excessive risk? Some scholars maintain that Sharia requires a 100% reserve ratio on demand deposits, as interest cannot be paid upon them. Others allow banks a certain amount of leverage. As for the prohibition on betting, although credit default swaps are prohibited, firms can still insure the finances of each other. More nuances abound in order to separate out anything that would be

logically equivalent to interest. Clearly, it is difficult to prohibit interest on the simplest of financial instruments, confounded further by the differing interpretations of Islam across the world. Yet, despite the difficulty in truly prohibiting interest, people feel an impetus to hold less conventional debt, and this impetus may be a constraint that their non-Islamic counterparts do not feel.

In some ways, the difference between Islamic and conventional finance is only in nomenclature. Do religiously compliant financial products merely mimic Western ones with different wording? Some sukuk traders feel that, at least to firms, Islamic finance merely offers a different set of investors and therefore another avenue to raise money, usually at the same cost of capital as conventional debt. However, differences exist in bankruptcy settlement, whether the intermediary needs to take physical delivery of goods, and other details; these are the details that matter when facing a crisis. Perhaps, then, the debt-like Islamic alternatives to conventional debt reduce some of the costs of a binding leverage constraint. Thus, firms financed as such may get the benefit of leverage without contributing to systemic risk.

This paper tests whether the limitation on debt held by firms due to efforts to comply with interest-free, Islamic finance decreases the frequency of crises and limits the severity of recessions. These firms, financed in a different manner, may not be susceptible to asset price spirals because their obligations would scale with profits. Accordingly, firms outside of the Muslim world may wish to finance assets using contracts and innovations developed by Islamic finance. In addition, countries may wish to enact regulation to limit leverage or encourage firms to take less leverage. Certainly, the absence of crisis is a public good. On the other hand, constraining firm financing may increase the volatility of the business cycle.

II. Relevant Literature

Very little empirical research on the macroeconomic effects of interest-free finance exists. Research on Islamic finance has generally consisted of heuristic claims that profit-and-loss sharing can cure financial cycles by scaling liabilities with assets or empirical analysis of one segment. Darrat (1998) empirically examined the volatility of non-debt money (demand deposits and cash) versus debt-money (savings accounts, etc) of Tunisia. Cihak and Hesse (2008) showed empirically that Islamic banks could compete with western banks in many cases. Archer and Karim (2006) theoretically analyzed capital structure and cost of capital, finding stylized facts to differentiate a Sharia-compliant firm's capital structure from the structure under Modigliani-Miller (1958), which held capital structure to be irrelevant, and other schools of thought.

The debate on interest-free finance revolves around whether or not constraints on financing can mitigate the probability of financial crises and decrease the amplitude of the business cycle. Either constraints can keep firms from reaching an optimal state or they can keep competitively motivated firms from following each other into a downward spiral.

The question of whether Islamic finance attenuates credit cycles has attracted increasing attention in the past thirty years. Minsky (1982) argued that lenders and borrowers will necessarily become over-zealous during good economic times. Firms will finance long-term assets with short-term debt until the marginal return on capital is equal to the interest rate, making their balance sheet extremely susceptible to a critical change in the interest rate. In doing so, the relative maturities of their assets and liabilities would not matter to them. When a critical change in the interest rate inevitably comes, their assets devalue and their leverage increases. Moreover, a higher proportion of firms become critically leveraged. The interest rate

they are charged rises as their leverage increases, and the process continues until they can no longer roll over their debt. Then they must sell off most of their assets to repair their capital structure, depressing prices, and entering debt-deflation.

Islamic financial scholars piggybacked onto the theories proposed by Minsky (1982) and argued that by prohibiting interest and encouraging profit-and-loss sharing, liabilities would scale with assets. Thus, there could be no debt-deflation crises because firms would not need to sell assets at discount to meet maturing liabilities. Khan (1986) showed stylistically how flexible-price and fixed-price models could be adapted to reflect an economy where the nominal value of deposits was not guaranteed. This nature of deposits manifests as a prohibition on loaning for interest, because deposits become equity shares in the financial sector's investments. He found that equilibrium rates of return, money supply, and output would still exist in such a framework. Moreover, he posited that the profit-and-loss-sharing mechanism in Islamic finance would minimize the credit cycle.

Chishti (1985) complemented the work of Khan with a different stylistic model. He developed an heuristic explanation into a stylistic model based upon two differential equations, relating external cash commitments to investment. He claimed that cash commitments lag investments and that this lag creates a cycle. Ultimately, he asserts that Islamic finance would prevent firms from reaching the point where they have taken on many cash commitments but investment has dried up, because cash commitments scale with asset returns. Thus, they would never enter debt-deflation and their ability to solicit new investments would not depend on firm value, as in the financial accelerator. Chishti does not calibrate his model or compare it to empirical data.

More recently, Chapra (2008) asked whether Islamic Finance could prevent financial crises similar to the 2008 crisis. He answered yes and qualitatively explained that profit-and-loss sharing, as well as the prohibition on *gharar* and *qimar* (uncertainty and betting) would protect the economy from the failures of collateralized debt obligations, credit default swaps, and more. However, neither provided empirical evidence to support their conclusions.

This paper combines the ideas of Islamic finance, different capital structure, debt-deflation crises, and financial accelerator. It also adds to the qualitative explanation of Islamic finance with empirical research. On the one hand, overleveraged firms and countries hitting financial constraints can trigger crises. This paper should detect that. On the other hand, proponents of Islamic finance propose stylistic models showing that the restrictions on capital structure due to Islamic finance would prevent financial crises and decrease the severity of recessions. This paper tests the costs and benefits of encouraging less leverage.

III. Question 1: Can Interest-Free Finance Limit Financial Crises?

In trying to estimate empirically the impacts of Islamic finance on an economy, we first turn to the effect on a country's likelihood of a crisis. The main mechanism by which a prohibition on charging interest may affect financial crises is via debt deflation. Going back to the early theories of crisis, Fisher (1933) argued that crises arose because, for exogenous reasons, firms need to sell assets to pay off liabilities. If enough firms sell assets at once, the rapid sale of assets drives their price down, hurting the balance sheets of all borrowers and increasing leverage throughout the market. As borrowers divert money to pay off debt, they spend less on goods and curtail output, hurting the economy as a whole. Moreover, as more debt becomes due, firms must sell off more debased assets to pay off debts or take on new debt to pay off old debt.

Eventually, the price of assets drops enough that firms go into negative equity, default on their loans, and go bankrupt. In other words, over-indebtedness is not easy to escape, since taking action to get out of debt and into a healthy financial state may result in a worse debt situation. This is the debt-deflation model of a crisis.

The likelihood that a country may suffer from a debt deflation crisis depends on its external capital structure. As long as a country has open financial markets, a firm may choose to finance via either equity or debt and may do so with a foreign or domestic source of capital. The breakdown of foreign–owned equity and debt in a nation constitutes a country's external capital structure. Some types of capital inflows are easy to withdraw from a country and leave that country with a collapsed asset market. Other forms of finance are more permanent. For example, while the secondary debt market in a country may be well developed and bond owners may divest with some ease, lenders of chunks of debt may find it impossible to withdraw from a contract. Even they may simply refuse to roll over loans, whereas if a multinational firm creates capital such as a factory in a remote area of a developing country, it cannot easily sell that factory, even at a steep discount. Some Islamic financial contracts act similarly; a lease behaves like debt until an event of default, at which point it acts more like foreign direct investment (FDI). Furthermore, equity does not lead to crises because the cash commitments scale to revenue.[3] Whereas high interest payments might send an otherwise profitable firm to bankruptcy and foreclosure, equity financing may allow a firm to continue operations and thus maintain output. With debt, obligations remain fixed regardless of the country output. Firms may have to sell off productive assets to pay debt that comes due, contracting output. How firms within a country choose to finance externally may potentially have effects on the probability of a debt-

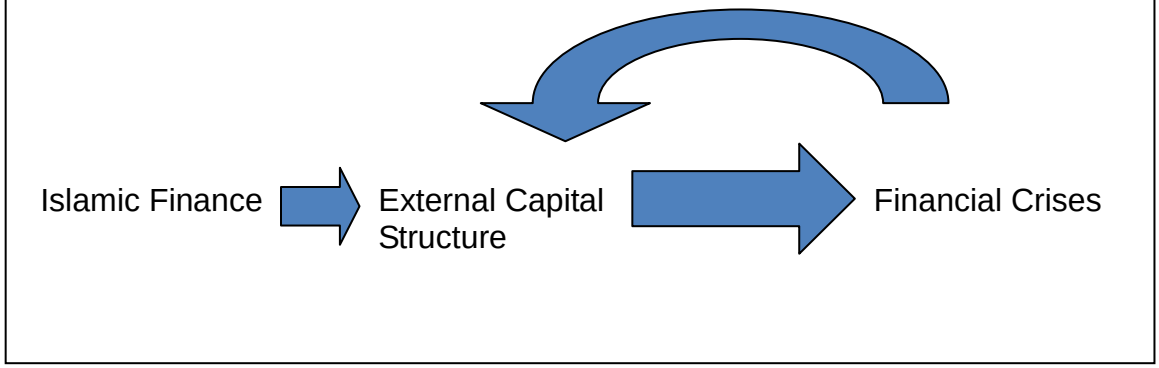
[3] Frankel and Rose (1996) argue the same point in regards to currency crises.

deflation crisis. Islamic financing rules, in turn, are likely to impact Islamic firms financing decisions.

IV. Empirical Method: Question I

Interest-free finance may limit financial crises by affecting external capital structure, the portions of a country's assets either owned by or owed to foreigners. This research estimates the effects that Islamic finance, through external capital structure, has upon the likelihood of a crisis. However, while leverage affects the probability of a crisis, crises are often characterized by a reversal of capital flows and a drastic change in a country's balance sheet, suggesting that capital structure is endogenous. Thus, the research uses a two-stage model with instrumented variables. The first stage of this model uses an ordinary least squares (OLS) regression to predict different measures of external capital structure from control variables and a trio of proxy variables to represent Islamic finance. The second stage attempts to predict financial crises using a probit regression model that incorporates control variables along with the dependent capital structure metrics predicted in the first stage. Figure 1 graphically displays the relationships of the two stages.

Figure 1. Endogenous causality relationship of Question I



Stage One

The first stage of Question I looks at the effects of Islamic finance upon various external capital structure metrics. The model uses an OLS regression to determine whether Islamic finance affects external capital structure. The dependent variables in this model are measures of external capital structure that may help predict crises in the second stage.[4] The research examines the debt portion of external liabilities as well as the equity portions of liabilities.[5] As a result, the dependent variables are the ratios of portfolio debt liabilities to all external liabilities, other debt to liabilities, total debt to liabilities, FDI to liabilities, portfolio equity to liabilities, and total equity to liabilities. The totals for equity and debt represent the cumulative effects of their two parts and combined, represent the total amount of financing supplied by foreigners. Thus, the model is

$$CS_{it}=\beta_0+\Sigma\beta_j X_{itj}+\beta_1 \text{Percent Islamic}+\beta_2 Y1991_t+\beta_3 Y1991_t*\text{Percent Islamic}_{it}+u_{it} \qquad (1)$$

where CS_{it} are the various external capital structure metrics such as portfolio debt's share of external liabilities or equity's share of liabilities. The independent, control variables nominal GDP, GDP per capita, resources, and openness are represented by X_{itj}, where j indicates which variable. The indices i and t represent country and year respectively.

To investigate the effect of Islamic finance on external capital structure, three key variables are included in the regression: the percent of a country's population which is Muslim, a dummy variable equal to one after 1991, and an interaction between these two variables. The interaction of the 1991 dummy and percent Islamic should capture the majority of the effects of

[4] The choice of regressors in the stage 1 model is based upon the model developed by Faria and Mauro (2007).
[5] The impact upon external assets were also examined. However, little relation was shown between Islamic finance and external assets. Moreover, liabilities matter more than assets in crises because the form of liabilities determines how easily capital can be withdrawn from a country.

Islamic finance, with the uninteracted terms soaking up any omitted variable bias. That is, there may be institutional factors or other similarities that Islamic countries share that also affect external capital structure. This is especially true in an absence of fixed effects. Thus, these effects will appear in the in the uninteracted percent Islamic term, with the interaction representing just the drive in these countries to make finance interest-free

The year 1991 marks a watershed in the emergence of Islamic finance due to the founding of the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), a major body in the development of Islamic finance. Furthermore, several major countries (Pakistan, Iran, Sudan, and Malaysia) had all created Islamic financial systems by, or around, 1991. Much theoretical work had already been done, and with the founding of the AAOIFI, the amount of sharia-compliant financial contracts and financial firms rose dramatically. An interaction between the 1991 dummy and the Muslim percent of a population is included in order to differentiate the financial changes in the Muslim world versus the world after 1991. The interaction between the 1991 dummy and percent Islamic should then capture the push to use less interest-bearing debt.

The aversion to carrying interest-bearing debt should result in fewer debt liabilities in Muslim countries after 1991. That is to say, if a firm is forced to carry less debt, they will turn to other financing options. Some of the alternate liabilities may behave similarly to debt and some may have qualities of both debt and equity.

In addition to the trio of variables used to represent Islamic finance, nominal gross domestic product (GDP), openness, real GDP per capita, and domestic resources are included as control variables. Economic size (GDP) matters in that it represents the ability of a firm to bring its products to market. A larger domestic market means that a multinational firm, building a

productive asset in a country, could sell the products of that asset more easily. GDP per capita captures the idea that, although all observations in the sample are of developing countries, capital structure may still differ across levels of development. Domestic resources are the percent of GDP attributable to fuel, ore, and metal exports. Natural resources could either tilt capital structure towards or away from Foreign Direct Investment (FDI). Natural resources may attract FDI more than other capital due to the need for foreign expertise to extract resources (Lane and Milesi-Ferretti, 2001). As a result, resources would attract FDI. Yet, resources are also particularly vulnerable to expropriation when capital is in place (Albuquerque, 2003). Whereas the value of FDI may be in brand names and networks, resources may deter FDI and attract debt or portfolio equity. Trade openness is the ratio of exports plus imports divided by GDP. Trade openness, like nominal GDP, represents the ability of capital to bring goods it produces to market and to bring capital out of the country. Trade openness also proxies for financial openness, as agents must exchange currency and often debt in order to purchase goods in a foreign country. [6]

While fixed effects are often used in panel estimation, they were not included in this regression, as capital structure research shows that the fixed effects overshadow the effects of the independent variables (Fan, Titman, and White, 2004). Moreover, since the percent Islamic population variable stays constant by country over time, it would be perfectly collinear with the fixed effects for country.

[6] The level of financial openness may affect external capital structure. According to Mendoza and Smith (2010), as countries first start to liberalize their capital account, firms take on a lot of debt and sell off equity due to a lower cost of capital. With time, the trend reverses and the costs of capital equalize, decreasing leverage.

Stage Two

In the second stage, a probit model is used to predict the probability of a crisis. The regression equation is

$$\Phi^{-1}(P(crisis_{it}))= \beta_0+\beta_1 CS_{it}(instrumented)+\Sigma\beta_k Z_{itk}+u_{it} \quad (2)$$

in which Φ^{-1} is the inverse normal function, and Z_{itk} are various country control variables where the index k represents which variable. CS_{it} are the instrumented capital structure metrics from stage one. The dependent variable in this second stage is the likelihood that a country enters a banking crisis, a debt-default crisis, a currency crisis, or a combination of these three. Because this variable takes only value of zero or one, a probit model is most appropriate. The probit model implies that there is an underlying, unmeasured, dependent financial health variable that affects the probability of a crisis. Intellectually, the independent variables affect the unobservable *susceptibility* to crisis, but do not entirely create crises. The independent variables from the first stage instrument for the external capital structure metrics. Additional control variables are included as well, as in Frankel and Rose (1996). The model uses a predictive format in which each of the independent variables is lagged. There is a potential endogeneity problem with a straightforward probit estimation. Although the model aims to show the effect of external capital structure on the existence of a crisis, without instrumentation, the coefficient is likely to also capture the effect of a crisis upon capital structure.

The dependent variable for the probit model, the existence of a crisis, comes from Reinhart and Rogoff (2009) crisis dataset. In their dataset, a financial crisis can be a banking, default, or currency crisis, since stock and inflation crises are not specifically tied to financial conditions. Rather than tallying the types of concurrent crises, this paper considers a crisis to occur when one or any combination of the three types of crisis is present. Often, different crises

happen simultaneously (take, for example, the potential effects on the Euro of the debt crisis in Greece in 2010). Additionally, if a country's currency crashes, and their debt is denominated in foreign currency, then they may have trouble paying the debt and enter a default crisis.

The control variables are broken down into four types of regressors: macroeconomic, external shock, liability composition, and foreign. Macroeconomic factors represent the state of monetary and fiscal policy in a country. These, in turn, explain the vulnerability of a country to speculative attacks on the currency. The macroeconomic variables include currency overvaluation (as measured by purchasing power parity (PPP) conversion from official exchange rate), domestic credit growth rate, and real GDP per capita growth.

To measure vulnerability to external shocks, the model includes ratio of debt to GNP, the ratio of foreign exchange reserves to monthly imports, and the current account surplus/deficit as a percent of GDP. Debt to GNP measures the size of debt in a country with regards to the country's ability to produce. Since debt eventually needs to be paid out of a country's production, Debt to GDP is a measure of leverage, but compares to how productive the assets are rather than how big. Strong reserves, low imports, and low current accounts indicate an internationally competitive country, one that is less dependent upon the availability of foreign products and capital. In other words, a country unlikely to be subject to crises

The external capital structure metrics from stage 1 are the liability composition variables.[7] The ratio of total debt to all external liabilities measures the leverage of each country. The further breakdown between portfolio debt and other debt examines any difference in how debt liabilities are structured – whether as liquid securities or as chunk bank loans and other debt

[7] Because STATA, the statistical software used, does not compute two-stage regressions with multiple instrumented regressors, the model is run for each external capital structure metric separately.

categories. These may affect crises because different types of financing may be more or less liquid, and thus vulnerable to capital flight.

For foreign variables representing the international lending and investment environment, the model uses the average lending rate from the United States, Switzerland, Japan, Germany, and the United Kingdom, weighted by the share of debt in each country's respective currency.[8] Since financial crises can be triggered by foreign financial conditions, foreign variables are included. The debt crisis of 1982, for example, was triggered by tight monetary policy in developed countries.[9] In addition to the average lending rate, the model also includes the OECD growth rate as a regressor. Output growth is a primary goal of many central banks, and the growth rate can indicate the status of monetary policy in a country. Tight monetary policy may, in turn, affect the liquidity needs of banks and cause them to pull capital out of a country.

V. Data: Question I

Each of the dependent variables for the first stage comes from the External Wealth of Nations Mark II database of Lane and Milesi-Ferreti (2006). This database possesses more data than the IMF's International Financial Statistics database, as the authors imputed data for missing observations. Most of this data only goes back around forty years, and religious composition of a country's population, in particular, how much is Muslim, has not changed much during that time. Thus, the 2009 PEW research center's statistics for percent of Muslims in the population of countries are used for every year in the sample. The data for real GDP per capita comes from the Penn World Tables and the remainder of the control variables are from the

[8] Actually, Frankel and Rose (1996) use money-market interest rates. However, they claim that using lending rates does not change any results, and the data for lending rates were more readily available.
[9] For further discussion, see Frankel and Rose (1996)

World Bank. Appendix A1 summarizes the data used in the first stage, including sample size and summary statistics for different subsamples of data. There is less data available from Muslim countries before 1991, and the breakdown between portfolio debt and other debt also limits the sample size severely. Initial observation shows that Muslim countries have higher other debt liabilities, accounting for 62% of external liabilities, than non-Muslim countries. In such countries, external liabilities consist of 51% other debt.[10] Resources, unsurprisingly, also contribute more to Muslim countries' GDP than to other countries. Before 1991, Muslim countries' GDP was roughly in line with other developing countries, but it is much lower after 1991.

The dependent variable for the second stage, the existence of a crisis, is constructed from Reinhart and Rogoff's (2008) list of crises. This paper includes currency, default, and banking as financial crises. The independent variables for the second stage all come from the World Bank. It consists of data on 36 developing countries from 1986 to 2003. The panel is strongly balanced, as there are 538 of 612 possible observations for the panel (87%). In the panel, seven countries are mostly or largely Muslim and four additional countries have significant Muslim minorities. These countries have 50% of observations in crisis periods as opposed to 60% for the dataset as a whole. Appendix A2 summarizes the data for stage two. Initial observation notes that Muslim countries tend to have a smaller debt/gross national income (GNI) ratio and a smaller current account deficit. Credit also seems to grow more slowly in Muslim countries. Other metrics appear similar regardless of whether or not a country is Muslim.

[10] A Muslim country, in this analysis, is any in which more than 50% of the population is Muslim

VI. Results: Question I

Table 1 shows the results of the first stage regression to determine the relationship between Islamic finance and a country's external capital structure. Before 1991, countries comprising 100% Muslims had 6% more portfolio debt than countries without any Muslims. Afterwards, the amount of liabilities attributable to portfolio debt dropped 11.3%. As a result, after 1991, a fully Muslim population would finance using less portfolio debt than a country with no Muslims. Instead, that financing may come from other debt sources. Other debt sources accounted for the same percent of financing before 1991 in a completely Muslim country compared to a non-Muslim country, but 14.8% higher after.[11] Total debt dropped 6.3% during this time, indicating that the push to reduce interest-bearing debt in these countries resulted in less overall debt.

The results also show that Islamic finance has a negative effect on a country's FDI share of liabilities. A country with a 100% Muslim population would have a ratio of FDI/Liabilities 4% lower than a country with a 0% Muslim population, but after 1991 that number decreases an additional 7%. However, this model suffers from a known omitted variable bias, as Faria and Mauro (2004) showed that institutional quality significantly affects FDI but institutional quality was not included in the model.[12] As a result, this paper focuses on the debt-side results rather than equity.

[11] Because of data collection and imputation performed by Lane and Milesi-Ferreti (2006) in constructing this dataset, the shares of total debt and total equity as a portion of liabilities do not always sum to one.

[12] Because the dataset constructed by Kaufman, et al (2003) on institutional quality does not go back before 1996, this paper could not include that data as well as the dummy variables relating to 1991, or else such variables would have been collinear.

Table 1: The Effect of Islamic Finance upon External Capital Structure: Pooled OLS

	Portfolio D/Liabilities	Other Debt/Liabilities	Total Debt/Liabilities	FDI/Liabilities	Portfolio E./Liabilities	Total Equity/Liabilities
Nominal GDP	0.003	-0.0273 ***	-0.0228 ***	0.0072 ***	0.0144 ***	0.0215 ***
	0.132	<.001	<.001	<.001	<.001	<.001
Real GDP per Capita	1.4411 ***	-0.4071	1.3861 ***	-0.1403	-0.0347	-0.1711
	<.001	0.388	<.001	0.315	0.131	0.235
Resources	-0.048 ***	-0.1143 ***	-0.1341 ***	0.0439 ***	-0.0065 ***	0.0369 **
	<.001	0.009	<.001	0.005	0.007	0.018
Openness	-0.057 ***	-0.1831 ***	-0.2983 ***	0.3488 ***	0.0334 ***	0.3826 ***
	<.001	<.001	<.001	<.001	<.001	<.001
Percent Islamic	0.0602 *	0.0215	0.1607 ***	-0.0386 ***	0.0002	-0.0393 ***
	0.058	0.781	<.001	0.007	0.829	0.007
Dummy Variable=1 after 1991	4.4255 ***	-10.819 ***	-6.2529 ***	6.1806 ***	1.3565 ***	7.4475 ***
	<.001	0.003	0.001	<.001	<.001	<.001
Interaction: percent Islamic after 1991	-0.1133 ***	0.1477 *	-0.0635 *	-0.0675 ***	0.0039	-0.0626 ***
	0.001	0.07	0.052	0.001	0.268	0.002
Constant	3.4038 ***	76.247 ***	79.7043	13.5722 ***	-0.6592 ***	12.9856 ***
	<.001	<.001	0.237	<.001	0.001	<.001
Observations	679	679	679	2476	2474	2474
R^2	0.2548	0.2139	0.244	0.1812	0.3069	0.221

Results of Question I, stage 1 regression. p-values are listed below the coefficient. ***=significant at 99% confidence level, ** at 95%, and * at 90%

The results from the second stage investigation of the effects of external capital structure on the likelihood of a crisis are shown in Table 2. The results show that a higher other debt to total liabilities ratio increases the probability of a crisis, as does a higher ratio of total debt to liabilities. After 1991, Islamic countries show a higher amount of other debt, indicating that Islamic finance increases the probability of a crisis. On the other hand, Islamic finance decreases the ratio of total debt liabilities. Therefore, Islamic economies, having less of this debt, were better off than their conventionally financed counterparts.

Combining the relationships of the second stage with those observed in the first stage, one can conclude that Islamic finance may increase the likelihood of a crisis by negatively impacting a country's other debt liabilities. However, Islamic finance also decreases the probability of a financial crisis because it decreases the ratio of total debt liabilities.[13]

These countervailing trends may perhaps be explained by the IMF System of National Accounts classification rules. Many Islamic financial structures are classified as liabilities even though they have some qualities similar to liabilities and some qualities similar to equity. Thus, although Islamic finance is correlated with more other debt, this may really mean that they have less other debt and more interest-free, Islam-acceptable debt substitutes. Since other debt is correlated with an increased likelihood of crises, the true effect of Islamic finance via other debt liabilities may be to decrease the probability of a crisis. Accordingly, the total debt effect is more reliable. Despite the fact that characterizing some types of Islamic financial structures as debt or equity can be challenging, Islamic financing rules appear to limit financial crises.

[13] FDI liabilities to total external liabilities ratio decreases the likelihood of a crisis. This indicates that the more external liabilities come from FDI, the less likely a crisis is to occur. However, Islamic countries showed a lower value of FDI liabilities (see Table 1), indicating countries with Islamic finance have a higher probability of a crisis than those without Islamic finance.

Table 2: The Effect Capital Structure upon the Likelihood of a Crisis: a Two-Stage Probit Regression.

PD/Liabilities (instrumented)	0.065 0.150					
Other Debt/Liabilities (instrumented)		0.042 *** 0.002				
Total Debt/Liabilities (Instrumented)			0.071 *** <.001			
FDI/Liabilities (instrumented)				-0.026 ** 0.046		
PE/ Liabilities (instrumented)					-0.031 0.345	
Total equity/Liabilities (instrumented)						-0.016 * 0.082
Debt/GNI	0.015 *** 0.001	0.010 * 0.059	0.010 * 0.094	0.008 *** <.001	0.010 *** <.001	0.008 *** <.001
Reserves/ Imports	0.006 0.880	0.050 0.242	0.023 0.619	-0.044 1.430	-0.042 0.182	-0.044 0.149
Current Account /GDP	-0.036 0.166	0.002 0.952	-0.034 0.252	0.017 0.201	0.018 0.183	0.015 0.257
Currency Overavaluation	0.383 0.118	-0.221 0.148	0.013 0.928	0.122 0.181	0.090 0.349	0.116 0.207
Domestic Credit Growth Rate	1.410 *** 0.002	1.018 *** 0.009	0.722 ** 0.032	0.471 ** 0.013	0.688 *** 0.001	0.453 ** 0.013
Real GDP per capita growth	-4.857 0.216	-5.769 ** 0.038	-6.612 ** 0.028	-4.158 ** 0.017	-3.679 ** 0.049	-4.086 ** 0.018
OECD Growth	41.147 *** <.001	20.180 0.169	21.187 0.127	16.793 ** 0.029	21.016 *** 0.002	18.323 ** 0.011
Foreign Lending Rate	-0.091 *** 0.008	-0.004 0.931	-0.004 0.929	0.019 0.388	0.011 0.580	0.017 0.428
Constant	-2.332 *** 0.006	-3.376 *** <.001	-6.307 *** <.001	-0.475 0.34	-1.067 *** 0.007	-0.636 0.163
Observations	202	202	202	539	539	539

Results of Question I stage 2, two-stage probit model. p-values are listed below the coefficient. ***=significant at 99% confidence level, ** at 95%, and * at 90%

VII. Question Two: Would Interest-Free Finance Increase the Volatility of the Business Cycle?

The second question in this paper explores the influence that Islamic financing may exhibit on the volatility of aggregate investment through a firm's capital structure decision. Firms' capital structure should influence the volatility of aggregate investment and thus the business cycle.

While the Islamic financial constraint may prevent margin calls imposed by lenders, it may have a different effect on the volatility of investment. On one hand, Islamic financing options should prevent contractions in investment because financing is asset-based, and the return is ideally determined *ex post*. In other words, financiers should share in the returns of the assets they finance. Thus, when an asset is doing poorly or drops in price, the financial obligations do not eat up cash from operations and do not threaten a potentially worthwhile asset's existence or use as collateral.

On the other hand, under Islamic finance, firms have fewer options for financing. A prohibition of interest could also increase volatility by constraining capital structure. Bernanke, Gertler, and Gilchrist (1996) found that financial frictions and constraints could exacerbate business cycles. Their financial accelerator model shows how the financial markets may amplify and propagate output fluctuations. Because there is a cost to lenders associated with reviewing a borrower's earning potential, and high collateral/net worth partially obviates the need for that oversight, firms with a higher net worth can get cheaper financing. Thus, greater collateral leads to lower rates. The opposite, more leverage and less equity to use for collateral, raises the interest rate. During a recession, a firm's profitability decreases and thus the present value of its assets drop, increasing its leverage. With higher leverage, firms face a higher external financing

premium. As such, they borrow less and invest less, amplifying the recession. Since firms must rebuild their profitability and value before they can get a lower premium, this mechanism can prolong the recession as well.

In discussing this accelerator, the authors claim that, in the presence of financial frictions, the financial accelerator behaves more strongly, possibly deepening recessions or being responsible for a debt-deflation crisis. Additional research into financial accelerators agreed with this conclusion.[14] If this conclusion is true, then Islamic finance, by constraining entrepreneur's funding options, could help prolong and aggravate financial cycles and crises. Furthermore, the authors argue that more financially constrained firms show "excess sensitivity" to monetary policy shocks. Bernanke, Gertler, and Gilchrist (1998) demonstrated that financial constraints which prevent firms from reacting to financial conditions strengthen the financial accelerator. Intuitively, if the link between investment and equity value is stronger in Islamic countries because firms are constrained from taking debt, then a mechanism that depends upon that connection will be a larger factor. Thus, Islamic finance may increase the impact of the financial accelerator and lead to more severe contractions in output.

Even though Islamic finance imposes a constraint that could exacerbate financial accelerator effects, the profit sharing preference of Islamic finance may disable part of the financial accelerator mechanism. The financial accelerator proposed by Bernanke, Gertler, and Gilchrist (1998) rests upon an external finance premium. When economic shocks cause a decrease in returns, equity and thus collateral values drop, debt obligations consume cash from operations and additional finance must come from outside the firm, which costs more. With

[14] The original model assumed a large, closed economy. Carlstrom and Feurst (1997) constructed a version of the financial accelerator model more easily calibrated, and Smith and Mendoza (2004) described how financial frictions and constraints could precipitate "sudden stop" crises in small, open economies.

higher costs of capital, less financing occurs. As Chishti (1984) argues, profit-sharing finance would prevent finance from absorbing all cash from operations during periods of low output, allowing financing to still occur internally. If internal funds can still finance some new and continuing investments, the financial accelerator, resting upon the need for external finance, would not play as large of a role.

This research examines the impact of Islamic finance on the volatility of investment by first looking at the impact that Islamic finance has on firm leverage and then on the impact that aggregate firm leverage has on the volatility of aggregate investment. The results should determine whether the exacerbating of interest-free finance on the financial accelerator or the ameliorating effect dominates the change in investment volatility.

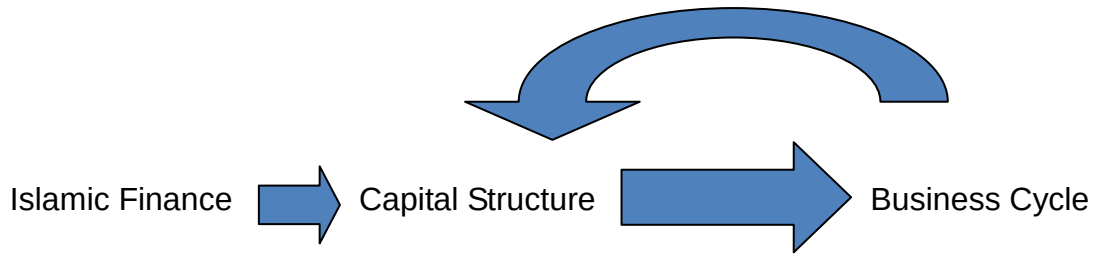
VIII. Empirical Method: Question II

To address whether and how a leverage constraint affects the business cycle, the model is once again split into two stages. In the first stage, an OLS regression is used to predict firm-level leverage from several control variables, while adjusting for fixed effects by industry and by each year/firm combination. Then, the coefficients of the year/firm dummies are regressed upon country factors that vary in time. This shows how much of a country's unique effects can be explained by measurable factors. Since this model is concerned with the effects of Islamic finance, the percent of the country's population that is Islamic is included as a country effect. Since firm-level data is not available before 1989, the model does not include a 1991 dummy variable as in Question 1. Instead, the model includes a dummy variable for the year 2001 and later as well as a variable that is the interaction of the year 2001 dummy and percent Islamic. The 2001 dummy effectively captures the liquidity growth of debt substitutes that Sharia-

compliant firms can now access. The results of this regression show the amount of country's effects on leverage that are explainable by Islamic finance.

In the second stage, the predicted and actual leverage results are aggregated by year and country and included as regressors in predicting the variability and rate of domestic investment within a country. In addition to leverage, the model also includes as regressors Tobin's Q, which is the ratio of the market value of assets to their replacement value, and the percent of the population that is Islamic. Furthermore, another independent variable is created from the interaction of leverage with percent Islamic. This interaction shows whether a leverage composed of Sharia compliant debt substitutes has a different effect than conventional leverage.

Figure 2. Endogenous causality relationship of Question II



The two-step estimation process captures the effect of Islamic finance on volatility of the business cycle appearing through the intermediary of capital structure. Furthermore, there is a possibility of endogeneity: The aggregate capital structure of firms in a country can move in response to economic conditions. During a recession, firms might dip into negative equity or be forced to write down the value of their assets. The two-step estimation, depicted in Figure 2, isolates the impact of leverage and financial constraints upon investment volatility. In this case, the two stages cannot be solved simultaneously.

Stage One

Stage one starts by predicting leverage ratios for individual firms each year. Fixed effect dummies are included for industry and for each country and year combination. The year/country dummy coefficients can afterwards be analyzed in order to see what country effects can be explained by the presence of Islamic finance.[15] The first model fit is

$$Leverage_{it}=\beta_0+\Sigma\ \beta_k D_k+\Sigma\beta_{tj}D_{tj}+\Sigma\beta_m F_{itm}+u_{it} \quad (3)$$

where D_k represents dummy variables for industry type k, D_{tj} are country/year dummies for country j at time t, and F_{itm} is firm characteristic m for firm i at year t.

In addition to these dummy variables, the model controls for firm characteristics: tax rates, asset tangibility, operating risk, return on assets, the logarithm of total assets, and market-to-book ratio. Tax rate is included because debt can shield income from taxes, as it is not taxed as profit and again as capital gains. Thus, a high tax rate is expected to encourage a higher leverage. However, as Fan et al. (2004) point out, these data can include loss carried forward between periods and not accurately represent the expected tax rate. Asset tangibility is included because tangible assets are better collateral. This collateral means that lenders should feel more confident supplying loans. Riskier firms may be accepted as equity in a diverse portfolio, but may be less likely to get loans. Profitable firms may generate more internal funds and need less debt. Larger firms fail less, so firm size may indicate a safer creditor and thus more debt. Conversely, larger firms may mean that more information is available to outside investors, and thus equity may be preferred. Market-to-book ratio can proxy for growth opportunities, and, as Rajan and Zingales (1995) discuss, firms with growth opportunities prefer equity investments.

[15] Fan, Titman, and Twite (2004) use a similar process to see what country effects can be explained by a variety of other regressors

Next, the coefficients β_{tj} from (3) are used to fit the model

$$\beta_{tj} = \alpha_0 + \alpha_n C_{jtn} + u_{it} \quad (4)$$

where C_n are country characteristics for country j in year t. Included in these country characteristics are the percent of a country's population which is Muslim, the dummy variable for years after and including 2001, and the interaction of those two variables, which captures the availability and liquidity of Sharia compliant debt substitutes. In countries where a certain percentage of assets are Sharia-financed and investors have an aversion to debt instruments, leverage should be lower, and thus the coefficients β_{tj} should be lower.

The ratio of liquid liabilities to GDP acts as a proxy for the size of the banking sector in each country. The reasoning is that different financial institutions have different preferences for different types of instruments. Banks have a comparative advantage at holding short term debt because of their ability and adeptness in monitoring borrowers. Institutional investors also supply funds but prefer liquid securities. Stock turnover and the size of the stock market with respect to GDP capture the effect of liquidity in the equity market, and the size of government bonds over GDP proxies the liquidity of the debt market.

Inflation and a development dummy are also used as country control variables. The value of fixed-rate debt is directly affected by a change in the inflation rate because the real return is the nominal rate minus inflation. Thus, inflation captures some aspects of how macroeconomic conditions are affecting the capital structure choices of firms and their financiers. A developed country dummy variable helps control for any element of financial institutions that may have been missed in other variables. The next stage attempts to separate the effects of leverage resulting from conventional financing and from Sharia-compliant financing.

Stage Two

The second part of this question looks at how leverage, as predicted by Islamic finance, affects recessions. An ordinary least squares regression is performed to predict the variance of domestic investment. The dependent variable in this model is the variance in the annual, percent growth rate of real domestic investment over the current year and four years previous. Investment varies procyclically and is the most volatile component of GDP; thus, it indicates the stage of the business cycle well. The model used is:

$$Var(I)_{it}=\beta_0+\beta_1 Q_{it} + \beta_2 Leverage_{it} +\beta_3 \%\ Islamic_i + \beta_4 Leverage_{it} * \%\ Islamic_i + u_{it} \quad (5)$$

where $Var(I)_{it}$ is the running 5-year variance in domestic investment for year i and country t and Q_{it} is Tobin's Q, the market value of assets divided by their replacement value. It is aggregated across all firms in one country at one time, using the predicted values from equation (3) in stage one. The percent Islamic variable is the percent of a population that is Muslim, percent Islamic*leverage is the interaction of leverage and percent Islamic. Lastly, an indicator variable equal to one for developed countries and zero for developing countries is also used to control for differences in volatility among developed and developing countries.

The innovation in this model, in addition to the instrumentation, is the use of percent Islamic as an explanatory variable and the interaction with leverage. The coefficient on leverage as predicted by Islamic finance and other variables should show the effect that the Islamic finance constraint has upon output volatility. Interacting leverage and percent Islamic should show the effect that Islamic finance has on the mechanism by which leverage affects the magnitude of recessions. This variable attempts to separate the effects of simply having a low leverage and having a leverage constrained by attempting to comply with Islamic financial regulation and Islam-acceptable debt substitutes. The percent Islamic itself largely controls for

omitted variable bias in any factors similar across Muslim countries. For example, many Muslim countries are resource rich, although tests with this variable found this particular similarity insignificant. Additionally, these countries have monarchies and components of Islamic law not specifically related to finance but which could impact it.

Tobin's Q provides control for this regression. Tobin's Q is the ratio of the market value of assets to their replacement value. If Q >1, then investors value assets more than they cost to buy. This indicates that it is worth buying new assets, and is indicative of investment and economic growth. Moreover, firms can smooth their investments since they do not need to wait until financing becomes available to invest. On the other hand, a situation in which Q<1 may indicate that investors do not value investing in more capital, and firms, stuck with low equity prices, must wait until equity prices rise to invest.

IX. Data: Question II

The Thomson Reuters Worldscope dataset supplies all of the firm-level financial data used in the first stage of this model. The years in the sample range from 1990 to the most recent financial statements of 2010. The same 39 countries are used here as in Fan et al (2004). Summary statistics can be found in Appendix A3.

To fit equation (3), the model uses over 90,000 observations. Since there are thirty-nine countries and twenty years, 780 dummy variables β_{it} are created for observations in (4). Including the industry dummies and the other regressors, the total number of independent variables is over the maximum allowed by the statistical software used, so the regression is performed in two parts.[16] The first includes the years 1990-1999 and the second 2000-2010.

[16] The maximum number of variables that STATA IC can use in a regression is 800, including internal variables.

Since the goal of this regression is to get the country/year dummy coefficients for each country/year combination, dividing the sample by year is acceptable. The results are slightly different than had the sample been combined and a single regression run, but the coefficients on the dummies should be very similar.

The data for independent variables in stage two largely comes from the World Bank. The existence of government bond capitalization to GDP data severely limited the sample size, as did the availability of liquid liabilities over GDP. Each of these regressors eliminates around 2/3 of observations. The estimates use various combinations of regressors in order to maximize sample size while attempting to keep as many regressors as possible. Table A4 houses the descriptive statistics for this stage. The remaining data, representing Tobin's Q, is aggregated from individual firm data from the Worldscope database. Chung and Pruitt's (1994) method for calculating Q is used.

The dependent variable for the second stage hails from calculations upon the Penn World Tables version 7.0. Tobin's Q is aggregated by country across time from calculations using Worldscope data. Leverage is also aggregated data from the Thomson Reuters dataset. Two measures of leverage are utilized in the model: one being the actual values from the preliminary regression and the second being the predicted values from stage one. The percent of a population that is Muslim remains from the PEW research center, and the indicator for developed country is from upon the World Bank. Summary statistics can be found in Appendix A4.

There are six countries with significant Muslim populations, four of which have majority Muslim populations. They are Pakistan, Indonesia, Malaysia, and Turkey. Of these, all but Turkey are noteworthy for their efforts to build up a system of Islamic finance. The two

countries with significant, but minority Muslim populations are India and Singapore. Singapore is noteworthy as the most developed financial center in that region of Asia.

X. Results: Question II

The results of the firm-level regression from the first stage are in Table 3. Table 4 shows the second part of this stage, in which the coefficients for the year and country effects from the first regression are regressed on country-specific variables.

As in Fan, Titman, and Twite (2010), return on assets shows a positive effect, possibly reflecting the pecking-order theory of capital structure. Additionally, operating risk has a strongly negative effect, perhaps because productive assets might not be able to make interest payments regularly. However, the important part of this regression was to generate the year and country effects for the second part of this stage.

The regression of these country effects on country factors shows that a country with an Islamic population, and thus the existence of Islamic finance, has a significant negative effect on the country dummy affecting leverage. This would indicate that, as our sample is almost entirely after the foundation of Islamic finance in 1991, firms in these countries felt the push towards Islamic finance and were impelled to finance less from interest-bearing debt. A Muslim population has a positive effect on firm leverage after 2001 across all versions of the model. Given the prohibition on interest in Islamic finance, this result seems counterintuitive. However, one possible explanation is that although Sharia-compliant debt substitutes behave more like equity than debt, they are classified as liabilities. This is the case even though the return on such

Table 3: The Firm-Level Regression of Capital Structure

	Leverage Ratio 1990-1999	Leverage Ratio 2000-2010
Tax Rate	-1.89E-08 ***	0.0041
	<.001	0.331
Asset Tangibility	-0.10965	-16465.8
	0.434	0.309
Operating Risk	0.000313 *	-2.6029
	0.057	0.459
Return on Assets	-0.02012 ***	0.9226
	<.001	0.507
Log(assets)	0.103575 ***	-5.4508
	<.001	0.92
Market to Book Ratio	-0.00024 *	-0.1349
	0.076	0.447
Asset Maturity	7.42E-06	0.7518
	0.609	0.352
Observations	31336	66960
R^2	0.1661	0.0204

Because fixed effects by industry and by each country and year are also included, no all-purpose constant is used.

Results of Question II stage 1, firm-level regression. p-values are listed below the coefficient. ***=significant at 99% confidence level, ** at 95%, and * at 90%

Table 4: The Determining Factors of Country Effects on Firm Leverage

	Leverage Ratio (I)	Leverage Ratio (II)	Leverage Ratio (III)	Leverage Ratio (IV)
Inflation	-16.2036 *	-0.1955 ***	-0.12144 ***	0.3024
	0.091	<.001	0.004	0.983
Stock Turnover	-0.98083	-2.06613 ***	-1.82359 ***	-2.2763 ***
	0.201	<.001	<.001	0.003
Liquid liablities/GDP	-0.00153 **			-14.7068 ***
	0.021			0.003
Govt bonds capitalization/ GDP			-875.856	-5960.68 **
			0.437	0.024
Total market cap/GDP	-2.36474 ***	0.186418	-0.83539	-2.9457 **
	0.001	0.655	0.111	0.015
Developed Dummy	-257.977 *	-319.924 ***		
	0.073	<.001		
Percent Islamic	-4.53909 ***	-2.5834 **	-0.41551	-6.165 **
	<.001	0.016	0.721	0.036
2001 Dummy	671.6324 **	403.9223 ***	804.5261 ***	900.1517 ***
	0.042	<.001	<.001	<.001
2001*percent Islamic	5.687829 **	9.159855 ***	4.825348 **	5.7849 *
	0.042	<.001	0.015	0.099
Constant	632.9856 ***	482.1812 ***	376.1448 ***	1574.878 ***
	<.001	<.001	<.001	0.001
Observations	187	602	219	89
R^2	0.2963	0.1683	0.4191	0.4531

Results of Question II stage 1, county-level regression. p-values are listed below the coefficient. ***=significant at 99% confidence level, ** at 95%, and * at 90%

certificates is often proportional to the firm's profits with no guaranteed nominal value.[17] Thus, as these debt substitutes and their secondary market became more common, firms took on more liabilities with both equity and debt characteristics, increasing their perceived leverage.

Table 5 shows the results from the second stage, which examined the effects of leverage on investment volatility. The results from the second stage indicate that more leverage does increase the variance of investment in the sample. However, using the values of leverage predicted in the first stage results in no significant relationship. This lack of significance, perhaps, results from the low R^2 value in the preliminary stage. Alternatively, it could indicate that endogeneity was correctly identified as a problem, and, when endogeneity is accounted for, Islamic finance does not affect investment volatility through leverage. The percent of a population that is Muslim also has a positive coefficient, indicating that Muslim countries have more volatile output. However, none of that volatility is attributable to Islamic finance via changes to a country's leverage. As a result, Islamic finance does not appear to increase volatility through the financial accelerator.[18]

[17] The reasoning for claiming that they are liabilities is that they can have a term after which they expire. In this way, they are not part of the permanent capital base of a firm, yet they pay off similar to equity. (System of National Accounts, Appendix II)

[18] Checking for omitted variable bias, resources as a percent of GDP were included in the regression. Since many countries in which a high portion of GDP comes from resources are more strongly affected by global economic slowdowns and recoveries, perhaps resources could explain some of the variance in domestic investment. However, the results were largely unchanged and the P-value of the coefficient on the resource variable was .286, indicating that resources were not contributing to an omitted variable bias.

Table 5: The Effect of Leverage and the Islamic Financial Constraint upon the Business Cycle

In country aggregates, each value is weighted by that firm's total assets	Variance of Investment	Variance of Investment	Variance of Investment	Variance of Investment
Tobin's Q	-0.882 ***	-0.875 ***	-0.733 ***	-0.678 ***
	0.007	0.006	0.002	0.004
Leverage	4.041 *	3.939 *		
	0.054	0.084		
Interaction of Leverage and Percent Islamic		0.011		
		0.821		
Predicted Leverage			0.002	-0.007
			0.741	0.234
Interaction of Predicted Leverage and Percent Islamic				0.001 **
				0.014
Percent Islamic	1.133 ***	1.111 ***	1.156 ***	1.202 ***
	<.001	0.001	<.001	<.001
Development dummy	-40.944 ***	-40.749 ***	-42.981 ***	-34.413 ***
	<.001	<.001	<.001	0.005
Constant	94.395 ***	94.420 ***	101.133 ***	97.681 ***
	<.001	<.001	<.001	<.001
Observations	540	540	540	540
R^2	0.1101	0.1102	0.0969	0.1104

Results of Question II stage 2 regression. p-values are listed below the coefficient. ***=significant at 99% confidence level, ** at 95%, and * at 90%.

As seen by the interaction between predicted leverage and percent Islamic, the leverage predicted by Islamic finance does not affect volatility in the same way as standard leverage. Since the sign of the interaction term is positive, it appears that the presence of Islamic finance slightly increases the variability of the business cycle. However, since the main effect of predicted leverage is negative and larger in magnitude than the interaction, overall the presence of Islamic finance may not increase the variability of the business cycle. This would support the view that the Islamic financing constraint prevented financial accelerators from increasing the persistence and magnitude of shocks.

XI. Conclusion and Further Research

Panel data suggests that Islamic finance has altered the external capital structure of countries by decreasing their total and portfolio debt and increasing their other debt liabilities. A further two-stage probit regression shows that the capital structure predicted by the first stage increases the probability of a financial crisis via other debt and decreases the probability of a crisis via total debt. With a possible misclassification of liabilities occurring in stage one, the result of total debt is more reliable. Moreover, the negative effect of Islamic finance on crisis via total debt is underestimated, as it contains an upward bias due to including other debt. Thus, this research concludes that Islamic finance decreases the likelihood of a crisis.

In examining the effect that Islamic finance has on the functioning of the financial accelerator theory, analysis shows that since the establishment of the secondary market in the early 2000s, Islamic finance has increased leverage and the variance of domestic investment. The increased leverage is most likely caused by a substitution of Islamic financial products that behave like both equity and liabilities. Although Islamic countries in general have more

volatility in the business cycle, this does not seem to be through the mechanism of interest-free finance.

The results of these two analyses suggest that implementing interest-free finance and financial contracts decreases the occurrence of debt-deflation crises without increasing volatility. The implications for non-Muslim countries are that, by limiting leverage, countries may limit their crises. Additionally, there appears to be no definite downside to interest-free finance with regards to increased volatility of investment and the business cycle.

Western regulators should encourage new financial products that have mixed qualities of debt and equity such as the products developed in Islamic finance. As Western firms entered the Islamic finance market with subsidiaries in such countries, they may also take Islam-acceptable financing methods back to conventionally financed regions of the world. Indeed, some Western firms have already started financing as such in order to attract investment from Islamic funds. To take a case in point, the Bear Mountain resort in Canada issued a sukuk in 2009 that was bid on in both North America and the Middle East (Reuters 2009).

Moreover, regulations that cap firm leverage, particularly of non-bank financial institutions, may be effective at limiting crises without the downside of increasing volatility. Finally, the research suggests that the tax advantage of debt, the tax-deductibility of interest payments, ought to be ended. This would lead to a less interest-based economy and, as this research shows, less financial crises without more volatility.

Ideally, research would be able to split the external capital structure into definitions more meaningful to Islamic finance. The IMF classification rules for different types of securities may weaken the results of this paper. The IMF classifies *mudarabah,* Sharia-compliant mutual funds, as deposits/stock in a corporation, but counts all other Islamic financial products as debt. This

catchall includes *musharakah*, partnership certificates that are essentially limited-term stock. Furthermore, other Islamic securities are all classified as debts. If these financial instruments share equity characteristics that prevent crises, yet are confounded and measured with a variable that promotes crises, removing them from the sample should clarity the effects of capital structure. More research needs to be done in differentiating the capital structures of countries in order to truly find whether there is a culprit among modes of debt.

Additionally, future research should see whether or not interest-free finance would affect the cost of a crisis, not just the probability of one. If Islamic finance makes crises less frequent but larger, perhaps there would be merit to increasing the amount of interest-free finance in the world. In terms of the volatility of the business cycle, more research may focus on different measures of capital structure or including additional variables to increase the model fit. This could be achieved, perhaps, by including trade credits or using the book value rather than the market value of the capital.

Finally, to merge the debate about capital structure, interest, and macro or financial effects, theoretical research may attempt to revamp the financial accelerator models to fit an interest-free financial system. Moreover, while Islamic finance may have a benefit or detriment to a country's susceptibility to crises and economic contractions, this research has not addressed the potential loss to overall growth rate due to the fact that these firms are constrained from taking on leverage.

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Appendix A1: Sample and Summary Statistics for Table 1

	Sample		<1991		Muslim		Muslim, <1991	
Variable	Observations	Mean	Observations	Mean	Observations	Mean	Observations	Mean
FDI/Liabilities	2476	28.318	1042	19.164	661	24.711	295	22.497
PE/Liabilities	2474	1.836	1040	0.438	661	1.807	295	0.382
Total Equity	2474	30.176	1040	24.416	661	26.517	295	22.879
PD/Liabilities	766	6.739	120	3.218	176	4.300	21	11.448
Other/Liabilites	766	50.704	120	30.443	176	61.712	21	59.324
Total Debt	2476	69.833	1042	75.629	661	73.487	295	77.127

	Sample		<1991		Muslim		Muslim, <1991	
Variable	Observations	Mean	Observations	Mean	Observations	Mean	Observations	Mean
GDP_nom	2474	51.907	1040	25.785	661	43.046	295	24.056
GDP_cap_real	2474	2.516	1040	2.0928	661	3.367	295	2.474
Resources	2474	25.753	1040	29.226	661	42.766	295	42.178
Openness	2474	34.497	1040	29.396	661	34.681	295	29.294
GDP_nom	766	88.053	120	24.548	176	69.028	21	50.564
GDP_cap_real	766	2.679	120	2.527	176	2.622	21	3.175
Resources	766	20.038	120	21.137	176	31.775	21	23.433
Openness	766	36.654	120	28.077	176	41.639	21	46.775

Countries with a majority Muslim population: Albania, Algeria, Azerbaijan, Bahrain, Bangladesh, Burkina Faso, Chad, Comoros, Djibouti, Guinea, Indonesia, Jordan, Kazakhstan, Kuwait, Lebanon, Malaysia, Mali, Mauritania, Morocco, Niger, Nigeria, Oman, Pakistan, Qatar, Saudi Arabia, Senegal, Sierra Leone, Sudan, Tajikistan, Tunisia, Turkey, Turkmenistan, and the United Arab Emirates.

Appendix A2: Sample and Summary Statistics for Table 2

	Sample		<1991		Muslim		Muslim, <1991	
Variable	Observations	#	Observations	#	Observations	#	Observations	Mean
Crisis	539	327	131	102	108	55	33	20
	227	125	29	34	41	24	10	8
		Mean		Mean		Mean		Mean
Debt/GNI	540	73.779	131	86.236	108	65.534	33	69.117
Reserves/Imports	540	3.796	131	3.270	108	3.612	33	2.861
Current Account/GDP	540	-3.357	131	-3.00	108	-0.436	33	-0.672
Currency Overvaluation	540	2.330	131	2.377	108	2.261	33	2.095
Domestic Credit Growth Rate	540	1.336	131	2.332	108	0.258	33	0.202
Real GDP/capita growth	540	0.016	131	0.010	108	0.022	33	0.016
OECD Growth	540	0.028	131	0.038	108	0.029	33	0.038
Foreign Lending Rate	540	13.529	131	14.026	108	13.701	33	13.300
Debt/GNI	228	54.300	34	70.221	41	56.853	10	54.568
Reserves/Imports	228	4.588	34	4.606	41	4.008	10	3.492
Current Account/GDP	228	-2.143	34	-1.789	41	-0.007	10	1.012
Currency Overvaluation	228	2.378	34	2.817	41	2.239	10	2.034
Domestic Credit Growth Rate	228	0.613	34	0.918	41	0.416	10	0.268
Real GDP/capita growth	228	0.014	34	0.012	41	0.023	10	0.023
OECD Growth	228	0.027	34	0.038	41	0.027	10	0.038
Foreign Lending Rate	228	13.743	34	13.591	41	13.044	10	13.168

Countries are: Algeria, Argentina, Bolivia, Brazil, Central African Republic, Chile, China, Colombia, Costa Rica, Cote D'Ivoire, Dominican Republic, Ecuador, El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Kenya, Malaysia, Mauritius, Mexico, Morocco, Nicaragua, Nigeria, Panama, Paraguay, Peru, Philippines, Romania, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay, Zambia, and Zimbabwe. Years are 1986-2003.

Muslim countries are: Algeria, Indonesia, Malaysia, Morocco, Nigeria, Tunisia, and Turkey.

Appendix A3: Sample and Summary Statistics for Table 3

	Sample		Significant Muslims		Majority Muslim	
Variable	Observations	Mean	Observations	Mean	Observations	Mean
Leverage	98296	303.866	17307	0.631	4604	0.852
Tax Rate	98355	198.035	17307	38.942	4604	50.225
Asset Tangibility	98355	0.9124	17307	0.932	4604	0.967
Operating Risk	98355	1.594	17307	1.3140	4604	1.9178
ROA	98355	8.207	17307	9.889	4604	9.609
Log Assets	98355	7.505	17307	6.387	4604	7.7014
Market to book ratio	98355	2.958	17307	2.668	4604	1.895
Asset Maturity	98355	2.816	17307	3.090	4604	2.571

The 39 countries are: Australia, Austria, Belgium, Brazil, Canada, Chile, Switzerland, China, Denmark, Gernmany, Spain, Finlnad, France, Great Britain, Greece, Hong Kong, Indonesia, India, Ireland, Israel, Italy, Japan, Korea, Mexico, Malaysia, New Zealand, Netherlands, Norway, Pakistan, Peru, The Philipines, Portugal, Singapore, Sweden, Thailand, Turkey, Taiwan, the United States, and South Africa.

Of those, Indonesia, Malaysia, Pakistan, and Turkey have a majority of Muslims. Singapore, India, and the United Kingdom have significant amounts of Islamic finance as well.

Appendix A4: Sample and Summary Statistics for Table 4

	Sample		Significant Muslims		Majority Muslim	
Variable	Observations	Mean	Observations	Mean	Observations	Mean
Var (investment growth)	555	85.328	105	179.918	60	183.955
Mean (investment growth)	555	4.474	105	5.076	60	3.913
Q	555	2.163	105	1.368	60	1.270
Leverage	555	1.678	105	1.824	60	2.172
Leverage * percent Islamic	555	23.595	105	110.505	60	180.851
Predicted Leverage	555	2.163	105	102.172	60	-65.393
P.Leverage * percent Islamic	555	450.605	105	-2228.786	60	-5636.005

Appendix B: Data Sources

Variable	Calculation	Source
Portfolio debt/liabilities Other debt/liabilities Total debt/liabilities	Each/total liabilities	updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007)
Nominal GDP GDP per capita Resources Openness		World Bank World Development Indicators (2010)
Percent Islamic	Assuming religious composition has not changed significantly over fourty years, this value does not vary over time	PEW Research Center. Mapping the Global Muslim Population (2009)
Existence of a crisis	Only counted banking, currency, and default crises as financial crises. Variable equal to one when any of these crises exist, zero otherwise.	Reinhart and Rogoff (2010) Dates for banking crises, currency crashes, sovereign domestic or external default (or restructuring), inflation crises, and stock market crashes: 1800-2010
Debt/GNI Reserves/Imports Current account/GDP Currency overvaluation Domestic credit growth rate Real GDP per capita growth OECD growth		World Bank World Development Indicators (2010)

Foreign lending rate	Calculated as the average lending interest rate rate of US, Switzerland, France, Germany, Japan, and UK weighted by the portion of debt of the country in question denominated in the currency of each country	
Leverage	Total debt/market value	Thomson Reuters Worldscope
Tax Rate	Income tax paid/EBIT	
Asset Tangibility	(Total assets-intangible assets)/total assets	
Operating Risk	absoloute value of % change in ROA from previous period	
Return on Assets	EBIT/total assets	
Log(Assets)	Base 10 log of assets.	
Market to Book Ratio	Market capitalization/(total assets-total liabilities)	
Asset Maturity	Gross property, plant, and equipment^2/(assets*depreciation)	
Inflation Stock Turnover Liquid liabilities/GDP Gov't bonds capitalization/GDP Total market capitalization/GDP		World Bank World Development Indicators
Var(I)	5 year running variance of percent change in gross domestic investment (ki*pop)	Penn World Tables 7.0
Tobin's Q	Calculated similarly to as specified in Chung and Pruitt (1994), without preferred stock.	Thomson Reuters Worldscope
Leverage	Predicted from stage one regression	Thomson Reuters Worldscope